Appendix J. Components of EC Architecture

INTRODUCTION

The architecture is an aggregate of components that provide the necessary services needed for electronic commerce (EC). The components and the services they provide are describe in this section. In many cases, the implementer will have to made choices based on the desired functionality and minimization of cost. For example, the specific security features impact the choice of capabilities and even the aggregation of functions within a component. Additionally, the user may decide to use a local translator or a shared centralized translator. Even though there is a standard architecture, the inherent and planned flexibility presents the user with several choices. Some of the options open to the user are discussed and component information pertinent to the selection process are defined in this appendix.

INVENTORY OF COMPONENTS AND SUPPORTING SERVICES

The following major elements have been identified in the system architecture:

- User
- Agency application systems
- Agency networks (e.g., DISN)
- Gateway
- Network entry point (NEP)
- Virtual network
- Value-added network (VAN)
- Trading partner
- Date and time service
- Broadcast servers
- Mailing list
- Signature services.

USER

The user is a person performing a Federal government application on one of the agency application systems.

AGENCY APPLICATION SYSTEMS

Agency application systems include such systems as a procurement system, a financial system, and an invoice processing system. The applications perform the following functions:

- Internal interface between agency management information systems (procurement, finance, property management, etc.)

- Generate procurement transaction contents

- Take in data for responses.

Agency applications will require some modification so that they can be linked to the EC infrastructure. This need for modification provides an opportunity for reassessing and perhaps reengineering those applications. A significant portion of the benefits from EC are expected from the reengineering of agency processes. Since a complete acquisition cycle involves the movement of documents among many agency functions (e.g., request creation and submission, procurement actions, finance actions, receiving, and finance again together with various review and approvals along the way), it is worth looking at tools and techniques that can enhance this flow of paperwork.

AGENCY NETWORKS

Many agencies, such as DoD, Department of Treasury, and Department of Veterans Affairs, have existing networks that tie together their agency application systems. The intent is to provide the necessary connectivity, compatible protocols, and interfaces such that an aggregate of most of the agency's networks will be tied together in an Internet environment, the virtual network. The agency networks capable of transporting X12 transactions will most likely require a gateway and an NEP. The gateway will generate the X12 transaction, and the NEP will receive the X12 transaction for relay to the VAN. Other agency networks will transport procurement information to a system which combines the functions of the gateway and the NEP.

GATEWAY

A gateway interfaces the applications to the virtual network. An agency network may exist between the applications and the gateway as a local option. Also, an agency may have dedicated communications resources that exist between the gateway and the virtual network. In this case, an additional component called an NEP will be required between the agency's dedicated communications and the virtual network. Otherwise, the gateway will connect directly to the virtual network.

The ASC X12 implementation conventions allow selected representations to be unambiguously documented for each agency's use. Different applications may share the same ASC X12 translator, which is usually licensed software. The gateway separates the ASC X12 translation from the application, which separates the maintenance procedures and reduces the work to assure that consistency is maintained between the transaction sets and the text files. For example, changes or additions to X12 or Electronic Data Interchange for Administration, Commerce, and Trade (EDIFACT) representations must be reflected in the transaction sets but will not necessarily require changes to all the application programs.

The separation of the translator from the application makes it virtually impossible to perform some security functions in the application. For example, a digital signature or encryption could not be performed until after the translation has occurred. Applications that require encryption or digital signature will probably benefit by placing the translator in the application.

The gateway performs the following functions:

- Mapping of application outputs to the X12 translator
- Translation of business system documents into X12 transactions
- Encryption, decryption, key management, and authentication
- Archiving and audit trails
- Translation of inbound data from X12 back to the application
- Transmission of formatted X12 transaction sets
- Addressing tables for the appropriate VANs or NEPs when NEPs are used
- Storage and forward services

- X.500 functions.

The flexibility in the architecture that is enhanced by the connectivity provided by the virtual network will allow users to establish connectivity and achieve total functionality without the NEP by adding the following functions to the gateway:

- Security/firewall

- Distribution of X12 transactions sets to all VANs or to specific VANs

- Date/time stamp reporting.

NEP

The NEPs provide connectivity via the virtual network to agencies and to external commercial VANs to transmit EDI transactions to and from government trading partners. The NEP may be required to provide either, or both, "event driven" and "store and forward" exchange data to and from the VAN and government components. Event driven is defined as real-time receipt and forwarding of message traffic, as may be required in the transportation of highly time sensitive data. Event driven requirements can be met from the recommended standard protocol suite; however, the supporting communications environment may required dedicated facilities. Initially, file transfers will probably be used if a NEP delivers ASC X12 transactions to a VAN. The NEP will initiate the transfer to the VAN; the VAN must provide readily available space for storage. Store and forward is appropriate for less sensitive data, batch data, or data that are not deemed time critical. The communication NEPs will have direct or indirect communications with all NEPs and gateways.

The NEPs must accommodate common agency protocol suites, the IPS, and the OSI protocol suite represented by the current version of GOSIP. The communications capability must also accommodate access to Internet.

The NEPs will require connectivity to different components to perform their intended functionality. The following connectivity is required:

- FTS2000 networks

- Internet

- Agency networks

- Other NEPs

- VANs

- Communication distribution points.

A NEP is almost always used when an agency uses an agency network to connect multiple gateways to the virtual network. When a NEP is required, the following functions will be necessary in both the gateway and the NEP:

- Addressing tables for the appropriate VANs

- Store and forward services.

Also when a NEP is required, the following functions will be transferred from the gateway to the NEP:

- Help desk

- Security/firewall

- Distribution of X12 transactions sets to all VANs or to specific VANs

- Distribution of inbound data internally to the addressed agency application systems

- Date/time stamp reporting

- X.500 directory services.

VIRTUAL NETWORK

The virtual network provides connectivity for any type of transactions including ASC X12 transactions among government systems and those of private industry. The virtual network physical implementation will probably create an aggregate of FTS2000, Internet, DoD networks, other communications networks supported and used by the departments, and VANs. The virtual network provides for the interworking of these networks for the

movement of EC messages. Hence, any protocol suite supporting the virtual network must provide an internetting capability.

VALUE-ADDED NETWORK

A VAN is an enterprise that provides network connectivity and value-added services, such as X12 translation services, EDI to facsimile services, and data base services. For the purposes of this architecture, any enterprise certified as providing connectivity to the virtual network may declare itself a VAN. The VANs seems like an excellent choice for broadcasting, distribution, or picJ-up. Since RFQs must be sent to all VANs, either the VANs or some equivalent would seem necessary. Further, when a trading partner submits a bid, it may use a VAN or NEP; it would be left to the discretion of the trading partner. The VANs perform the following services:

- Distribute the X12 transactions to trading partner using their desired protocols

- Convert X12 to the format desired by the trading partner (fax, paper, diskette, tape, E-mail, etc.)

- Provide archiving and audit trails

- Accepts data from vendor and translate to the requirements of the government

- Provide services required in the VAN agreement (e.g., 24-hour operation)

- Provide store and forward services as required by the trading partner

- Provide trading partners with a single call for pickup and delivery.

TRADING PARTNER

A trading partner is a vendor that wishes to sell to the Federal government. In order to become a trading partner, the vendor must either hire the services of a VAN or declare itself a VAN and become certified as such. Transactions may also be transferred between different government users; economic benefit is almost certain if an infrastructure can be utilized instead of developing additional infrastructure.

DATA STORAGE/RECOVERY

An NEP will have full redundancy in order to provide temporary archiving and data recovery capability of transactions. Long-term archiving and recovery of transactions will be the responsibility of the functional user.

Out-bound transmission errors or failed messages will be retransmitted in accordance with the transport protocol. If errors disallow communications the network control center will be notified.

Incoming transmission errors are the responsibility of the sender. The transport protocol should be robust enough to notify the sender that transmission services have been terminated. The sender should contact the network control center to coordinate resolution of the problem.

DATE AND TIME SERVICES

Although the major components now apply date/time stamp reporting at the point the transaction first reaches a government computer (either gateway or NEP), contracting officers may desire to use the equivalent of a postmark. The X12 transactions may be transmitted to the U.S. Postal Service (USPS) to receive their date and time stamp when this service becomes available. The USPS then forwards the transactions to the government gateway or NEP.

BROADCAST SERVER

A broadcast server meets a request by the Business Requirements Group to provide a government source at which vendors will have equal access. All one-to-all transactions would be placed on this server, and at specified times these transactions would be made available to be downloaded by VANs. The advantage of this approach is to avoid the case where a transaction such as an RFQ would be delivered to one VAN on time and due to the failure of the government system would be delivered late or not at all to another VAN. The actual implementation of this broadcast server may or may not be a bulletin board system. VANs will be responsible for ensuring trading partners are registered with the Federal government before they respond to an RFQ.

However, bulletin boards allow vendors an efficient way of sorting through the potentially long list of RFQs and examining only those of interest; for example, vendors that do not sell pencils will not be interested in examining RFQs for pencils. Still another advantage is that vendors have the option of searching the bulletin boards at their convenience based on current needs and requirements without have RFQs delivered directly to their mailbox and without the need to initiate any action. Furthermore, VANs may provide vendors additional services such as EDI translation, and delivery of only selected RFQs based on product categorization. Of course, there will be a cost to vendors for these services that must weighed against the benefits they offer receiving all RFQs issued.

Viewed from a different vantage point, searching a bulletin board at a convenient time requires vendors initiated action. VANs can be used to eliminate this requirement.

In addition to offering quick implementation, bulletin boards have the advantage of familiarity for many vendors. Thus, many vendors will be able to utilize them immediately. Another advantage is that tools can be developed (or purchased) to automate searching.

MAILING LIST

Mailing lists are already in widespread usage, particularly on the Internet. To make use of mailing lists, one or more lists could be created for this purpose. All that is required is a system that supports an electronic mail service. The electronic mail system creates an "alias" that results in substituting a single electronic mail address for the electronic mail address of multiple users. Architecturally, a mailing list can be viewed in the same way as a VAN. RFQs would be sent to the mailing list and this would result in it going to many vendors, in much the same way that an RFQ sent to a particular VAN ends up being delivered to many vendors. The details of how this is handled in either situation are not of any particular importance to the overall architecture. The use of mailing lists may be particularly convenient for those with access to the Internet. These could be set up based on geographic location, product categorization, or any other grouping where there is a shared interest. Again, tools to automate searching or provide additional services could be implemented.

SIGNATURE SERVICES

Authentication of trading partners may be accomplished in one or more of the following ways: a signature service by the USPS similar to the date/time stamp discussed above; authentication and encryption techniques, such as privacy enhanced mail provided by third-party sources; or the Mosaic system (a DoD effort that uses the Tessera card and passwords for authentication as well as encryption). Until the Federal government reaches consensus on a signature service, several different methods of authentication will need to be accepted in the technical architecture. During the development of the trading partner agreement, the government and the trading partner are required to agree on the authentication procedure; the government shall be flexible in these negotiations as long as the final agreement does not compromise ECAT principles and is economically acceptable.